

26 December 2003

To: Paul Philp
DOE Project Manager, Run IIb CDF Detector Project

From: Pat Lukens
Project Manager for the Run IIb CDF Detector Project

Subject: Run IIb CDF Detector Project November 2003 Report

Attached is the monthly report summarizing the November 2003 activities and progress for the Fermilab RunIIb CDF Detector Project. This report is available electronically at:

<http://www-cdf.fnal.gov/run2b.html>

electronic cc: J. Appel
E. Arroyo
N. Bacchetta
D. Benjamin
J. Cooper
B. Flaugher
H. Frisch
J. Huston
R. Hughes
D. Knapp
B. Knuteson
J. Kotcher
S. Kuhlmann
T. Liu
N. Lockyer
P. Lukens
T. Miao
J. Monhart
H. Montgomery
V. Pavlicek
K. Pitts
L. Ristori
R. Roser
TJ Sarlina
K. Stanfield
E. Temple
D. Toback
C. Trimby
V. White
B. Winer
M. Witherell
P. Wittich

RunIIb CDF Detector Project
Progress Report No. 12
1 - 30 November 2003

I. PROJECT DESCRIPTION

The primary goal of the CDF Run IIb Detector Project is to enable the detector to exploit the physics opportunities available during Tevatron operation through 2008. The data from Run II will represent a set of detailed measurements that can be compared with the predictions of the Standard Model at the highest available collision energy. The increased size of the data sample will allow us to study the top quark by measuring the details of its production and decay mechanism. In addition, we plan precision electroweak and QCD measurements, continued searches for a variety of phenomena that are predicted to exist beyond the Standard Model framework, and to explore CP violation in the b quark sector. The detailed physics goals of the upgrade are described in the Technical Design Report (TDR).

The major tasks of this upgrade are:

- Upgrade the calorimeter by replacing the Central Preradiator Chamber with a device with shorter response time to allow operation in a high-luminosity environment, and adding timing information to the electromagnetic calorimeters.
- Upgrade the data acquisition and trigger systems to increase throughput needed for higher luminosity operation and efficiently trigger on the higher multiplicity events of Run IIb.

II. OVERVIEW OF PROJECT STATUS – P. Lukens

Final versions of the Baseline Change Proposal (BCP), Project Execution Plan, and Project Management Plan were submitted to DOE in preparation for the ESAAB meeting on 8 December. The results of this meeting were favorable, and the new baseline proposal was accepted.

A Production Readiness Review was held for the Pulsar boards, the major component for the Level 2 Decision crate (W.B.S. 1.3.2). The reviewers were satisfied with the tests that have been performed, and see no reason not to proceed with procurement. The board was also reviewed by the PPD Electrical Engineering department, in accordance with CDF circuit guidelines.

III. PROJECT MILESTONE SUMMARY

CDF Level 2 Schedule Milestones from the Resource Loaded schedules

WBS	Title	Baseline Comp. Date	Forecast/Actual Completion Date	Complete
1.2.1.10.1	First phototube order placed	9-May-03	1-Apr-03	Yes
1.2.2.2.7.1	Prototype Testing Complete	16-May-03	28-Mar-03	Yes
1.2.2.2.7.4	ASD->TDC Cables ready for installation	16-May-03	26-Aug-03	Yes
1.2.2.2.7.2	CEM Splitters ready for installation	19-May-03	29-Jul-03	Yes
1.2.2.2.7.3	PEM Harnesses ready for installation	2-Sep-03	28-Apr-03	Yes
1.2.2.2.7.5	All cables done and ready to install	2-Sep-03	26-Aug-03	Yes
1.3.5.2.5	Arrival of 0/10 PCs from the vendor	10-Sep-03	10-Sep-03	CR in process
1.2.1.10.2	1 st Calorimeter WLS fiber holder finished	7-Oct-03	7-Oct-03	CR in process
1.2.2.2.7.8	VME Crate ready for installation	7-Oct-03	30-Apr-03	Yes
1.3.1.6.7	First Prototype TDC available for testing	19-Nov-03	19-Nov-03	CR in process
1.2.1.10.4	1 st CPR module finished and tested	11-Dec-03	12-Feb-04	
1.2.2.2.7.10	Upstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.11	All EM Timing components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.6	ASD/TB ready for installation	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.7	Downstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.9	TDC boards ready for installation	7-Jan-04	16-Oct-03	Yes
1.3.3.2.3.4	Begin fabrication of Prototype Finder 1/3 board	8-Jan-04	8-Jan-04	
1.2.1.10.3	First set of Calorimeter phototubes tested	30-Jan-04	20-Oct-03	Yes
1.2.1.10.6	1 st CCR module finished and tested	12-Feb-04	8-Apr-04	
1.3.3.8.1.9	Prototype XFT Linker Module available for testing	26-Mar-04	26-Mar-04	
1.2.1.10.5	2 nd set of Calorimeter phototubes tested	21-May-04	18-Feb-04	
1.3.4.4.1.4	Prototype Event Builder hardware arrives	3-Jun-04	3-Jun-04	
1.2.1.10.7	50% Calorimeter CPR Detectors Tested	4-Jun-04	2-Aug-04	
1.3.4.5.3	Production Readiness Rev - Event Builder	24-Jun-04	24-Jun-04	
1.2.1.10.8	50% Calorimeter CCR Detectors tested	30-Aug-04	26-Oct-04	
1.3.2.6.3	Begin production of Level 2 Pulsar system	17-Sep-04	17-Sep-04	
1.3.3.10.3.3	Preproduction XFT Stereo Assoc Modules	29-Nov-04	29-Nov-04	
1.3.6.5	SVT ready for installation	13-Dec-04	13-Dec-04	
1.3.1.12	Beginning of TDC Production	10-Jan-05	10-Jan-05	
1.3.4.5.4.4	Arrival of Event Builder hardware	3-Feb-05	3-Feb-05	
1.2.1.10.10	Final Calorimeter CCR Detector Tested	24-Mar-05	19-May05	
1.2.1.10.9	Final Calorimeter CPR Detector Tested	24-Mar-05	19-May05	
1.3.5.5.5	Arrival of 70 L3 & 15 DAQ PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.5.6.5	Arrival of 140/20 PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.3.8.3.3	Begin Production of XFT Linker Modules	24-Mar-05	24-Mar-05	
1.3.3.2.6.9	Begin Production Finder SL7 boards	28-Mar-05	28-Mar-05	
1.3.5.8	Finish Purchase of Computers for L3/DAQ	14-Apr-05	14-Apr-05	
1.3.4.8	Finish Event-Builder Upgrade	5-May-05	5-May-05	
1.2.1.10.11	Final set of Calorimeter phototubes tested	6-May-05	29-Apr-05	
1.2.1.10.12	End of Central Preshower Project	6-May-05	19-May05	
1.2.3.5	End of Calorimetry Project: Level 2	6-May-05	19-May05	
1.3.2.9	Pulsar Level 2 subproject ready for installation	9-Jun-05	9-Jun-05	
1.3.1.14.16	Data Concentrator Production Completed	29-Jul-05	29-Jul-05	
1.3.3.10.4.6	XFT Production Stereo Modules complete	18-Aug-05	18-Aug-05	
1.3.3.23	XFT Ready for Installation at CDF	29-Sep-05	29-Sep-05	
1.3.1.13.10	TDC Production Board testing complete	30-Sep-05	23-Sep-05	
1.3.1.16	Run 2b TDC Ready for Installation	30-Sep-05	23-Sep-05	
1.3.8	Finish Run 2b Trigger DAQ project	30-Sep-05	30-Sep-05	

IV. PROCUREMENT – P. Lukens

University of Tsukuba submitted the purchase orders for Calorimeter phototubes November 2003. This order covers the remaining needs for the full system, and was placed well ahead of schedule (note milestone 1.2.1.10.11).

INFN submitted the purchase order for the high voltage system used for the Preshower and Crack chambers.

V. PROJECT HIGHLIGHTS

1.1 – Silicon Detector

A “close out” plan for the silicon project is currently being developed. The current scope of the close out includes construction of 15 staves and a small number of Layer 0 modules. These units will be mounted onto a prototype barrel structure, and a full system readout test will be performed. Results of this will be published, and the work done to develop the Run IIb silicon detector will then be available to future detector developers.

1.2 – Calorimeter

1.2.1 Central Preshower and Crack Detector – Steve Kuhlmann

The Central Preshower/Crack Upgrade continued to make progress in November. The focus this month was on the final specification of the high voltage system. This was a successful operation and the order for this system has been placed through INFN. Delivery is expected in the spring of 2004. INFN also purchased additional scintillator during November as the funds have now been released for use. Work continues to develop and finalize the specifications for the fiber procurement.

The first production phototube box was delivered from Michigan State University to Argonne National Lab. We also received four production optical cables from MSU and have tested them successfully at ANL. Testing of the first full scale Crack Prototype, which was started last month, continues with encouraging results.

1.2.2 Electromagnetic Timing – Dave Toback

All work on the EM Timing portion of the schedule has been completed, the Level 2 milestones have been closed out, and the components are ready to install.

1.3 – Data Acquisition and Trigger

1.3.1 TDC (Time to Digital Converter) – Henry Frisch, Ting Miao

We are continuing on the board schematic for the TDC. At the same time, we are working on fixing some minor problems that still exist in the FPGA. The crucial problem is that we are failing in the transfer of the Level 2 small buffers to the one large memory that

communicates with the VME bus. We suspect that the settling time is insufficient in the current design and we are currently engaged in trying to prove that this is the problem.

Discussions are underway with the Particle Physics Division Electrical Engineering group to add engineering support to this project in order to speed up the development and eventual testing of the prototypes.

1.3.2 Level 2 – Ted Liu, Peter Wittich

The CDF Level 2 Trigger system continues to make progress on the following fronts:

- Pulsar hardware, firmware and VME software,
- PCI and CPU performance studies, and
- S-LINK data format definition for all data paths.

All Pulsar prototypes have been fully tested for robustness. No design problems have been identified therefore we are convinced there is no need for any design revisions. This includes the following components:

- Pulsar motherboard,
- Hotlink transmitter and receiver mezzanine cards,
- Taxi transmitter and receiver mezzanine cards, and
- Back of crate transition module.

Both Pulsar firmware and VME software have been greatly improved to allow fully automated testing. With the automated testing procedures and the complete success of all prototypes, we are ready for Pulsar hardware preproduction, roughly six months ahead of schedule. The mezzanine card production has been finished and all testing has been completed. Preproduction of the Back of crate transition modules has been completed. The Production Readiness Review has been done and production has begun.

1.3.3 XFT (eXtremely Fast Tracker) II – Richard Hughes, Brian Winer

The Linker upgrade work at Ohio State University has been focused on implementing the improved tracking linking algorithm in the latest Altera Stratix devices. We have fit the design into the target device (an EP1S25), and we have successfully tested the full design with the simulator. Work continues on the Linker and Finder upgrade modules to determine which devices will actually be used on the board and their specific layout (schematic capture). Recent hiring actions at both OSU and University of Illinois have increased the physicist effort on this project, and will improve progress.

1.3.4 Event Builder – Bruce Knuteson

The Cisco switch is expected at Fermilab at the end of calendar year 2003. The VMIC 7805 boards that will be used to read out the VRB's are scheduled to arrive at Fermilab at the end of November. In the meantime, we are consolidating code from the D0 system and sketching out the software for the new system.

1.3.6 SVT (Silicon Vertex Tracker) – Luciano Ristori

No work is scheduled to begin on the Silicon Vertex tracker trackfitter and merger boards until later in calendar year 2004.

VI. FINANCIAL STATUS

The new baseline costs are summarized in the table below:

	Baseline (\$K)		New Scope (\$K)	
	Cost	Cont.	Cost	Cont.
Silicon	\$ 12,008	\$ 5,145	\$ 2,527	\$ 396
Calorimeter	\$ 342	\$ 335	\$ 342	\$ 335
DAQ	\$ 3,788	\$ 1,678	\$ 3,788	\$ 1,678
Admin.	\$ 1,285	\$ 407	\$ 1,006	\$ 302
Total	\$ 17,422	\$ 7,565	\$ 7,663	\$ 2,711

	Funding Plan in Current Year \$K				
	FY02	FY03	FY04	FY05	Total
DOE MIE	\$ 3,460	\$ 3,509	\$ 1,673	\$ 1,732	\$ 10,375
DOE R&D	\$ 1,670	\$ 480			\$ 2,150
Foreign Contributions	\$ 39	\$ 342	\$ 252	\$ 10	\$ 643
U.S. Universities	\$ 24	\$ 225	\$ 103	\$ 26	\$ 378
Total	\$ 5,193	\$ 4,556	\$ 2,028	\$ 1,768	\$ 13,545

	Non DOE	R&D	DOE MIE	Total
Silicon		\$ 2,150	\$ 2,923	\$ 5,073
Calorimeter	\$ 690	\$ -	\$ 677	\$ 1,367
DAQ	\$ 330	\$ -	\$ 5,466	\$ 5,796
Administration		\$ -	\$ 1,308	\$ 1,308
Total	\$ 1,020	\$ 2,150	\$ 10,375	\$ 13,545

	MIE Obligations in Current Year \$K					
	FY02	FY03	FY04	FY05	FY06	Total
Silicon	\$ -	\$ 1,045	\$ 913	\$ 569	\$ -	\$ 2,527
Calorimeter	\$ -	\$ 151	\$ 189	\$ 1	\$ -	\$ 342
DAQ	\$ -	\$ 242	\$ 769	\$ 2,777	\$ -	\$ 3,788
Administration	\$ -	\$ 213	\$ 308	\$ 317	\$ 168	\$ 1,006
Total Base Obligations	\$ -	\$ 1,652	\$ 2,179	\$ 3,665	\$ 168	\$ 7,663
Contingency	\$ -	\$ -	\$ 922	\$ 1,577	\$ 212	\$ 2,711
Total	\$ -	\$ 1,652	\$ 3,101	\$ 5,241	\$ 380	\$ 10,374

	Total MIE Obligations in Current Year \$K					
	FY02	FY03	FY04	FY05	FY06	Total
Silicon	\$ -	\$ 1,045	\$ 1,110	\$ 713	\$ 55	\$ 2,923
Calorimeter	\$ -	\$ 151	\$ 424	\$ 52	\$ 49	\$ 677
DAQ	\$ -	\$ 242	\$ 1,146	\$ 4,043	\$ 36	\$ 5,466
Administration	\$ -	\$ 213	\$ 422	\$ 433	\$ 240	\$ 1,309
Total	\$ -	\$ 1,652	\$ 3,101	\$ 5,241	\$ 380	\$ 10,374

	Total Obligations in Current Year \$K					
	FY02	FY03	FY04	FY05	FY06	Total
Silicon	\$ 1,670	\$ 1,525	\$ 1,110	\$ 713	\$ 55	\$ 5,073
Calorimeter	\$ 41	\$ 597	\$ 617	\$ 62	\$ 49	\$ 1,366
DAQ	\$ 22	\$ 363	\$ 1,307	\$ 4,069	\$ 36	\$ 5,796
Administration	\$ -	\$ 213	\$ 422	\$ 433	\$ 240	\$ 1,309
Total	\$ 1,733	\$ 2,698	\$ 3,456	\$ 5,277	\$ 380	\$ 13,544

VII. VARIANCE ANALYSIS – P. Lukens

Several Level 2 milestone dates have moved due to the restructuring of the overall Project. Change Requests have been created and are expected to take effect in December of 2003. The critical path to completion of the Project has not changed.

VIII. BASELINE CHANGES

Change Request #8 was submitted and approved in November. This changes the Administration scope in the baseline plan. The cost reduction from this change is contained within the BCP submitted on 8 December 2003.

IX. FUNDING PROFILES

The funding profile is shown above in Section VI.